



ISS On Orbit Analysis Technologies and NASA Bedrest Plans

NASA/Barbara Corbin
44th ISLSWG Meeting
May 22-24, 2013
Osaka, Japan





Solicited Input

- **ASI**
 - Salvatore Pignataro, Jean Sabbagh
- **NASA**
 - Space Biology
 - David Tomko, Sid Sun, Scott Richey
 - ISS National Lab
 - Marybeth Edeen, Bert Magh, Mike Read
 - Human Research Program
 - David Baumann, Mark Ott
- **CNES**
 - Guillemette Gauquelinkoch, Didier Chaput
- **JAXA**
 - Aiba Tatsuya, Masafumi Yamamoto, Masaki Shirakawa
- **DLR**
 - Guenter Ruyters, Hans-Ulrich Hoffmann
- **CSA**
 - Perry Jonson-Green
- **ESA**
 - Nadine Fritz, Jason Hatton, Josef Winter, Joaquim Castellsaguer, Patrik Sundblad



Topics

- Microbial Monitoring
- Human Biological Samples
- Non-Human Biological Samples
- Sample Handling and Preparation
- Microscopy
- Integration Recommendations



Microbial Monitoring

	Agency	Carrier	Accommodation	Objective	Sample access	Status	available	samples	analytes	Technology
Microb-A	JAXA	ISS	MSPR	Microbial monitoring	swab	pre-ph A	2014	surface	identification and quantification of microbes	LOOP mediated ISOTHERMAL amplification (LAMP)
Microbial Monitoring System	NASA	ISS	TBD	Microbial monitoring	TBD	Req'ts Definition	2016	Water, TBD	identification and quantification of microbes	Quantitative PCR (DNA-based)



Human Biological Samples

	Agency	Carrier	Accommodation	Objective	Sample access	Status	available	samples	analytes	Technology
MicroFlow 1	CSA	ISS	Soft stowage	Detection and quantification of biomedical parameters	Ground processed (current phase)	on orbit	now	cells and microbeads	blood cells and factors	Flow cytometry (samples prepared on ground)
In-flight Lab analysis	NASA	ISS	HRF rack or soft stowage	Sample processing and detection biochemical parameters and immunoassay	direct or pre-processed samples	COTS Down-select in process	early 2015	blood, maybe urine and saliva	Medical, and physiological bio-markers	Various, potential Flow cytometry
ImmunoLab	DLR	ISS	Russian segment	Immune parameters	direct or pre-processed samples	Ph B2	early 2015	Blood, maybe urine	Immunology parameters	Biochemical, immunobiological assays, fluorescence



CSA MicroFlow 1



NASA In-flight Lab Analysis (Concept)

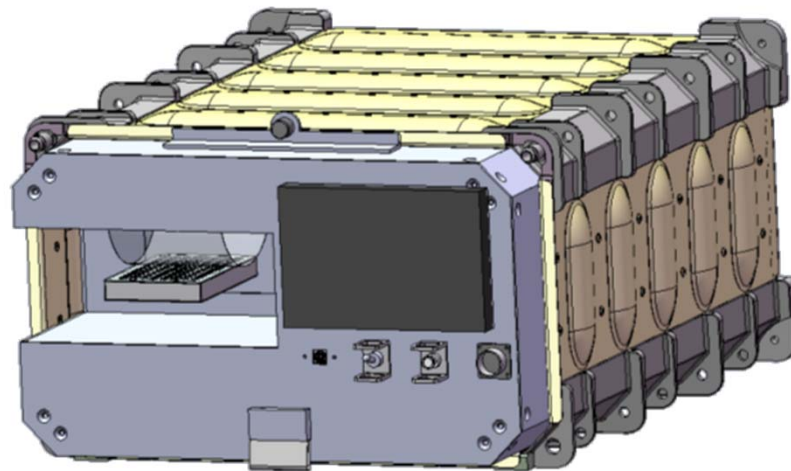


DLR ImmunoLab



Non-Human Biological Samples

	Agency	Carrier	Accommodation	Objective	Sample access	Status	Available	samples	analytes	Technology
Platereader	NASA	ISS	express rack	spectrophotometric analysis of cells and other samples	pre-processed on ground or direct	on orbit	Now	cells		Spectrophotometry with fluorescence
PCR with tissue lysing prep (Wet Lab RNA SmartCycler)	NASA	ISS	express rack	PCR + lysis	cells	PDR on 6/4/13	Late 2014 (SpX-5)	various biology	gene expression	TBD



NanoRacks Platereader



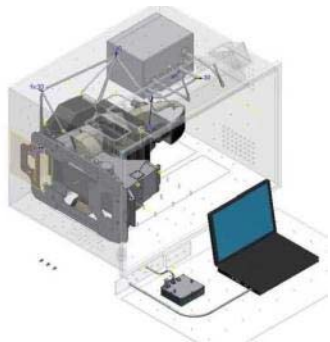
Sample Handling and Preparation

	Agency	Carrier	Accommodation	Objective	Sample access	Status	Available	samples	analytes	Technology
Disposable glovebox	NASA	ISS	soft stowed	provide one additional lvl of containment		Available for manifest	mid 2012	tox lvl 1		
Wet Lab Kit	NASA	ISS	soft stowed	provide standard lab tools		Available for manifest	mid 2012	various		
Modification of MSG (Lif Science Ancillary Hardware - LSAH)	NASA	ISS	MSG	enable biological work in two lvls of containment		CDR complete	Late 2013 (SpX-3)	bsl 1 or 2, and fixatives		
MSG Video Upgrade Equipment (VUE)	NASA	ISS	MSG	High definition video of MSG ops		CDR complete	Early 2014 (SpX-4)			
MSG Rodent Research Support Equipment	NASA	ISS	MSG	Dissection of rodents		CDR complete	Early 2014 (SpX-4)			Articulating dissection table and MSG back cover panel
Mouse bone densitometer	NASA	ISS	EXPRESS Rack	bone densitometry	Holds entire mouse	CDR complete	Early 2014 (SpX-4)			Dual Energy X-ray Absorptiometry (DEXA)
Animal Handling and Dissection kits	NASA	ISS	soft stowed	provide standard animal handling tools and euthanasia		CDR complete	With Rodent Habitat hardware on SpX-4 (early 2014)	rodents		
Analytical Containment Transfer Tool (ACT2)	NASA	ISS	soft stowed	provide 3 lvls of containment during sample transfer	Luer-lock interface	Contract in work	Late 2014 (SpX-5)	tox lvl 2, fluids only		
Protein crystal X-ray diffraction machine	NASA	ISS	soft stowed	X-ray crystallography analysis tool		Pre-contract negotiation	mid 2015	microfluidic protein crystals		X-ray diffraction

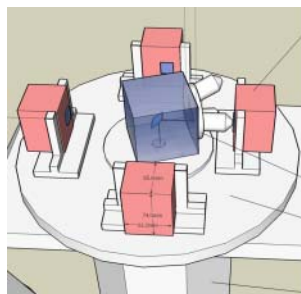


Microscopy

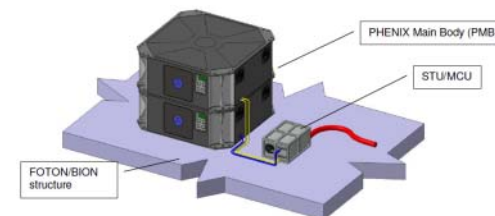
	Agency	Carrier	Accommodation	Objective	Sample access	Status	Available	samples	analytes	Technology
Microscope observation system	JAXA	ISS	MSPR	Fluorescence microscope	samples provided in containers	Delivered for HTV3	Now	plants, cells, small animals...	GFP, DSRED,	Fluorescence, teleoperation
Flumias	DLR	Texus, Satellites/ISS	Incubator/TBD	3D live cell imaging, protei-protein interaction, ratio-metric measurements	samples provided in containers	Ph A equivalent	Texus early 2014 ISS/Satellite 2016	human/plant /cultured cells, small plants, and protists	fluorescence markers, incl intracellular	confocal scanning microscopy (LED), works with centrifuge
Phenix Macroscope	CNES	ISS/Satellite	flexible/adaptable	Fluorescence macroscope	samples provided in containers	Ph B for Foton Ph 0 for ISS	Foton 2016 ISS TBD	plants, cells, small animals...	GFP, localisation,	leica, fluorescence, works with centrifugation
Optical and Reflective microscopes	NASA	ISS	soft stowed	observe biological growth samples, in situ sample observation	samples in slides, in situ	on orbit				



JAXA Microscope Observation System



DLR FLUMIAS



CNES Phenix



Integration Discussions to occur before the November 2013 ISLSWG (NASA will facilitate)

- Microbial Monitoring
 - NASA and JAXA draft joint objectives/requirements and discuss current developments
- Immunoassays
 - NASA and DLR discuss allocation of assay development for their respective systems
- Flow Cytometry
 - NASA and CSA draft joint objectives/requirements and potential future developments
- Microscopy
 - JAXA, DLR, CNES, NASA draft objectives/requirements and discuss current developments